REMARKS/ARGUMENTS

In response to the Office Action mailed June 30, 2006, Applicants amend their application and request reconsideration. In this Amendment, examined claim 4 and non-elected claims 8-14 are cancelled and claim 15 is added so that claims 1-3, 5-7, and 15 are now pending.

In this Amendment, claim 3 is written in independent form as amended claim 3, claim 4 is rewritten in independent form as amended claim 1, and claim 5 is rewritten in independent form as amended claim 5. Some punctuation changes are made and grammar is adjusted, as necessary, in view of the way in which claims are combined. However, no claim now pending is substantively amended with respect to the claims presented for examination.

New claim 15 is supported by the description in the specification from page 9, line 31 to page 11, line 9.

As described in the patent application, the invention concerns a semiconductor laser having ridge waveguide that includes a structure providing improved performance. The invention particularly concerns the structure of an electrode contacting the ridge of a ridge-shaped waveguide. As described in the patent application, there are numerous variables, sometimes producing contrary effects to each other when individually adjusted, in structural elements of the laser and electrode. The ridge waveguide, as is conventional, includes a ridge with a dielectric film having an opening through which the electrode makes contact to an underlying semiconductor layer, usually called a contact layer. As explained in the patent application, in such lasers, the facets are formed by cleaving. Because of the influence of the electrode on the cleaving process, the facet is spaced from the electrode. The spacing affects the uniformity of current flow through the active layer of the semiconductor laser. The larger the spacing between a facet and the electrode, in a direction perpendicular to the facet, the more distorted is the current distribution within the semiconductor laser. In other words, it is desirable to make that separation

as short as possible while not adversely affecting cleaving, a characteristic feature of the elected species. In that elected species, the separation is less than 20 μm.

Another consideration in the cleaving process is the thickness of the insulating layer that includes the opening through which the electrode makes contact to the ridge. The thicker the insulating layer, the more difficult and potentially inaccurate the cleaving, particularly with respect to obtaining a cleaved surface that is perpendicular to the substrate of the semiconductor laser. An important achievement in the invention is the reduction of the thickness of that insulating film to obtain desired and accurate cleaving, particularly when, as in the invention, the electrode has a relatively large thickness. In the invention, for example as explained in the patent application at page 10 in lines 5-19, the thickness of that insulating film is reduced to 250 nm or less. This feature, originally described in claim 4, is part of amended claim 1.

Another important feature of the invention is the laminated structure of the electrode that makes contact with the ridge. That electrode has, according to the description of the patent application and the claims, two electrode layers. The first electrode layer includes, sequentially laminated, a titanium layer and a gold layer. According to claim 3, the gold layer has a thickness of at least 700 nm. In the first electrode, according to amended claim 5, the layer of titanium is vapor-deposited and the gold layer has a thickness of at least 200 nm. In that laser of amended claim 5, the second electrode layer is plated gold so that that second layer can be made relatively thick. As described in examined and amended claim 5, the gold-plated second electrode layer has a thickness of at least 800 nm, slightly thicker than the gold layer of the first electrode in the laser according to claim 3.

In view of the amendment of the claims, only the rejections with regard to examined claims 3, 4, and 5 are pertinent. If those claims are patentable, then so are the remaining claims 2, 6, and 7.

Claim 3 was rejected as anticipated by Nomoto et al. (published U.S. Patent Application 2003/0165169, hereinafter Nomoto). Claim 4 was rejected as

unpatentable over Nomoto in view of Yokoyama et al. (U.S. Patent 6,323,507, hereinafter Yokoyama). These rejections are respectfully traversed.

It is fundamental, that to anticipate a claim, a single prior art publication must disclose every limitation of the claimed invention. That stringent test is not met by Nomoto with respect to claim 3, as examined or as presented here. The ridge waveguide semiconductor laser according to claim 3 includes first and second electrode layers. The first electrode layer includes a titanium electrode layer and a gold electrode layer, laminated in that order. Moreover, the gold electrode layer has a thickness of at least 700 nm. As described in the patent application from page 9, line 29 through page 10, line 4, it is intended that this gold electrode layer, typically vapor deposited, have a thickness substantially larger than the conventional thickness of such electrodes.

In rejecting claim 3 as anticipated by Nomoto, at page 3 of the Office Action, the Examiner stated that the first electrode layer in the laser structure described by Nomoto includes laminated titanium and gold electrode layers with the gold electrode layer having a thickness of at least 700 nm. This statement is incorrect and not supported by Nomoto. In rejecting claim 1, the Examiner directed attention to paragraphs [0064]-[0066] no Nomoto. According to those paragraphs, the corresponding gold layer has a thickness of 600 nm. A review of the remainder of Nomoto, including the many described embodiments, does not reveal a thicker gold layer in the first electrode and particularly not a gold layer having a thickness of at least 700 nm. Because Nomoto fails to meet this limitation of claim 3, Nomoto cannot anticipate that claim.

New claim 15 further describes the second electrode of the ridge waveguide semiconductor laser of claim 3 as also being gold. However, that layer is a gold plated layer, meaning that its thickness can be much greater than the thickness of a vapor deposited layer. That layer has a thickness of at least 800 nm. Thus, the structure described in new claim 15 includes, as part of the electrode, gold layers having a total thickness of at least 1,500 nm, a thickness well beyond anything

contemplated by Nomoto. Therefore, the semiconductor laser of claim 15, like the semiconductor laser of claim 3, is clearly patentably distinct from Nomoto.

In the rejection of claim 4, i.e., amended claim 1, the Examiner focused on the limitation of examined claim 4 that describes the insulating film on the semiconductor layer of the ridge waveguide as having a thickness less than 250 nm. The Examiner asserted that all other limitations of claim 4 were disclosed by Nomoto and that the limited thickness insulating film was described in Yokoyama, although no specific passage of Yokoyama was cited. The Examiner quoted an unidentified portion of Yokoyama as disclosing "If the dielectric (insulating) layer has a thickness greater than 100 nm, the crystallographic property of the other layers tends to degrade." After substantial searching, a similar sentence was found at the end of column 7 of Yokoyama. However, the quotation in the Official Action removed and replaced very important words in the sentence. That sentence does not refer to a "dielectric (insulating) layer"; it refers to a "dielectric current-blocking layer". Neither that passage of Yokoyama nor any other passage specifically identifies what layer is being referred to in that passage, but the context of Yokoyama makes clear that reference is being made in that passage to the dielectric layer 20 illustrated in many figures of Yokoyama.

Yokoyama employs a current blocking structure in a semiconductor laser. That current blocking structure includes at least three semiconductor layers, a p-type layer, an n-type layer, and a second p-type layer, laminated together. As known in the prior art, under certain biasing conditions, these layers can produce what is referred to as a thyristor effect, leading to undesired current flow. This current flows due to a switching phenomenon that desirably occurs in a thyristor and that is highly undesirable in a semiconductor laser. In order to combat that leakage current flow, in the structure described by Yokoyama, a thin dielectric layer 20 is deposited on a semiconductor layer followed by the deposition of the p-type, n-type, and second p-type current blocking layers. The presence of the dielectric layer desirably blocks current that could otherwise flow in the thyristor structure. See Yokoyama at column

10, lines 41-43, describing the function of the dielectric layer 20 as well as the thyristor effect.

The reason the final sentence in column 7 of Yokoyama refers to employing a dielectric layer with a thickness no larger than 100 nm so that "the crystallographic property of the other layers is not degraded" is readily understood in the context of Yokoyama. Unless a very thin layer of dielectric is used in the current blocking structure, it is impossible to grow a semiconductor layer on the dielectric layer that has sufficient crystallinity to function as a single crystal semiconductor material. The defects in such a grown layer propagate throughout the several subsequently grown semiconductor layers of the complex structures illustrated in Figures 5 and 8B and described Yokoyama. For that reason, Yokoyama must use a very thin dielectric current-blocking layer that does not unduly disrupt crystalline structure.

Consideration of Yokoyama structures also discloses the presence of a dielectric layer 14 having an opening 14a through which contact is made by an electrode to an underlying semiconductor layer. The electrode 15 protrudes through that opening 14a. See the description at column 10, lines 54-61 of Yokoyama. It is this dielectric layer 14 that has the same position, function, and structure in the semiconductor laser of Yokoyama as does the insulating film referred to in examined claim 4 and amended claim 1.

It is entirely erroneous to have compared the dielectric layer 20 in Yokoyama to the insulating film of examined claim 4 and it would be erroneous to continue to apply that comparison in examining amended claim 1. The position and function of the insulating layer 20 in Yokoyama is entirely different from the insulating film of the invention. Further, the thickness of the dielectric layer 20 in Yokoyama is limited because of considerations regarding the growth of semiconductor layers on top of the dielectric layer. No semiconductor layers are grown on top of the insulating film according to the invention, nor on the insulating layer 14 of Yokoyama. Only metal electrode films are deposited on that dielectric layer 14 of Yokoyama and the insulating film of the invention. The reliance upon the thickness of the dielectric layer

20 in Yokoyama is legally erroneous because of the enumerated differences in structure and function between that layer and the film referred to in the claims. An examiner cannot establish *prima facie* obviousness by simply citing unrelated information in a prior art publication and asserting that that information is pertinent to an element of the claimed invention when there is no relationship to the prior art elements with respect to function.

As already stated, what needs to be compared, in the examination, to the specified maximum thickness of the insulating film of amended claim 1 is the thickness of the insulating layer 14 in Yokoyama. However, Yokoyama never discloses the thickness of that layer 14 and, therefore, there is no basis for asserting that Yokoyama could establish *prima facie* obviousness with respect to examined claim 4 or amended claim 1. For the foregoing reasons, reconsideration of the rejection with respect to claim 4 is requested, along with allowance of amended claims 1 and 2.

The rejection of claims 5-7 is understood to be based upon the non-patent publication attached to the Official Action. However, the publication attached is not the publication listed on the PTO-892 form nor the publication mentioned at page 4 of the Office Action. The publication described at page 4 agrees with the publication listed on the PTO-892 form. Nevertheless, the portion of the non-patent publication referred to in the final paragraph at page 4 of the Official Action agrees with the disclosure of the non-patent publication that was actually attached to the Office Action. The Examiner is respectfully requested to correct the error by supplying, with the next communication, a supplemental PTO-892 form correctly identifying the document relied upon, which seems to have some relationship to the document cited in the Office Action of June 30, 2006, either by withdrawing the previously cited publication or supplying a copy of that publication.

Claims 5-7 were apparently rejected as unpatentable over Nomoto in view of an article by Cheng et al., "Effect of Au Thickness on Laser Beam Penetration in Semiconductor Laser Packages". This rejection is respectfully traversed because the

subject matter of the non-patent publication has no relationship to the claimed invention.

Claim 5, now rewritten in independent form, describes the structure of the first and second electrode layers of the electrode that contacts the semiconductor layer with the ridge-shaped waveguide, though the opening in the insulating film. That electrode includes two electrode layers, the first electrode layer having a titanium layer and a gold layer and the second electrode layer, which is a gold-plated layer that is relatively thick. As described in the patent application, the claimed structure ensures a low-resistance contact relatively free, if not completely free, of breakdown. See the description in the patent application at least on page 12, line 29 through page 13, line 14. Nomoto, the principal reference, was not asserted to disclose such a structure.

The Cheng article was relied upon as disclosing at its page 398 a gold coating layer of two microns thickness to achieve high weld strength and good solder adhesion. Of course, a rudimentary study of the Cheng publication shows that it refers to welding together parts of packaging for a semiconductor laser. The article describes the coating of an Invar alloy housing with a layer of gold to achieve, by laser welding, reliable attachment of a lead. Invar is well known to be a metal alloy and, according to the description, there is an optimum thickness of gold on the metal housing, considering the degree of penetration of laser light, in welding an external lead to the housing.

Cheng has no relationship whatsoever to how thick an electrode of a semiconductor laser should be to achieve a particular goal because Cheng never discloses internal leads directly connected to an electrode of a semiconductor laser device. Moreover, the reference to Invar makes clear that Cheng is directed to external packaging of semiconductor lasers, which is entirely unrelated to the particular structure of a semiconductor laser that is housed within such a package. There has been a fundamental error in the examination of claims 5-7. The thickness of gold employed by Cheng has no possible relationship to the thickness of a gold

electrode on a semiconductor laser. The rejection is plainly erroneous and must be withdrawn as to amended claims 5-7.

In this Amendment, three examined claims are rewritten in independent form without any substantive amendment. Punctuation and formatting changes are made in claim 2. No other amendments are made. Therefore, any new rejection, based upon any new applied prior art or new legal ground cannot possibly be a final rejection since original claims are still presented.

Reconsideration and allowance of claims 1-3, 5-7, and 15 are earnestly solicited.

Respectfully submitted,

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